ADVANCED MACHINING
TOWARDS IMPROVED MACHINABILITY OF DIFFICULT-TO-CUT MATERIALS

Edited by:
A.K.M. Nurul Amin (Chief Editor)
Dr. Erry Yulian Triblas Adesta
Dr. Mohammad Yeakub Ali

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Chapter 1

Influence of Workpiece Preheating on Chatter and Machinability of Titanium Alloy - Ti6Al4V

A.K.M. Nurul Amin, K. Kamaruddin, M. Abdelgadir

Department of Manufacturing and Material Engineering, Faculty of Engineering, IIUM, Gombak, Malaysia. Department of Manufacturing and Industrial Engineering, Faculty of Mechanical and Manufacturing, KUiTTHO, Batu Pahat, Malaysia.

e-mail address of corresponding author: akamin@iium.edu.my

1.0 INTRODUCTION

Though classified as a group of "difficult-to-cut" material, titanium and its alloys are have wide applications in the aerospace industry owing to their unique high strength-weight ratio which is maintained at elevated temperatures and their exceptional corrosion resistance. In this work, experimental investigations of the influence of preheating using induction heating on machinability of titanium alloy Ti-6Al-4V ASTM B348 were conducted. Uncoated straight grade of cemented carbide inserts were used. The cutting speed was varied in the range from 40 to 160 m/min with varying depths of cut and feed rates. The experiments of end milling operation conducted on Vertical Machining Centre (VMC) were design to look into vibration and chatter, chip formation, tool wear and surface finish. It has been established that the machinability of the investigated titanium alloy can be enhanced in terms of lower tool wear, better surface finish, lowering of instability of chip formation and chatter, increase in chip-tool contact length, shifting of the hot spot away from the tool edge and finally lowering of the dynamic stresses acting on the tool.

Unique combinations of properties such as, high specific strength, which is maintained at elevated temperature, high fracture and corrosion resistance, have made titanium and its alloys very useful materials for aerospace and petrochemical applications. However their high cost and poor machinability are major constraints towards their wide spread applications. Ezugwu et al. [1] observed that success machining of titanium and its alloys depends largely on overcoming the problems associated with high cutting temperature and cutting pressures, small chip-tool contact length (which is about 1/3 that in the case of steel), serrated chip formation and chatter. Chatter is also undesirable because of its adverse effects on surface finish, machining accuracy and tool life [2]. Talantov and Amin [3] and Amin [4] established